C2 Processing in CFOR Command Entities

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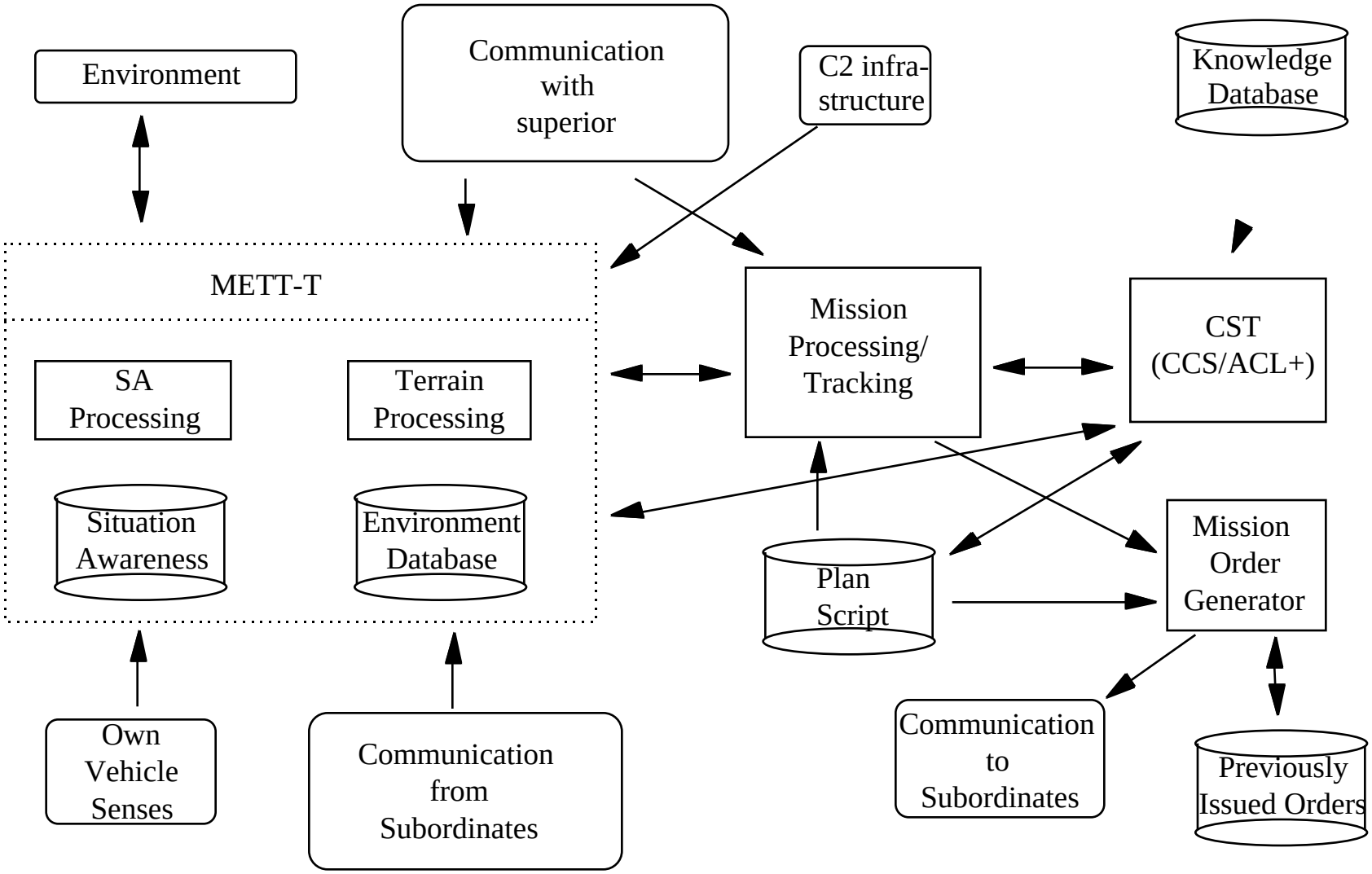
Outline

- Command Entity Functionality
- CE Architecture
  - Planning and replanning (CCS)
  - Execution and monitoring(ACL+)
- Future Issues

CE Functionality

- armored Co can perform and defend
  - according to a CCSIL Op Ord from Battalion
  - directing Platoons via CCSIL Op Ords and RFAGO's
- Extending Co level in CY 96
  - Advanced maneuver, FIST, CSS, Engineer
- Developing basic Bn in CY96
  - maneuver, S2, S3, FSE

CE Components Overview



Constraint Satisfaction

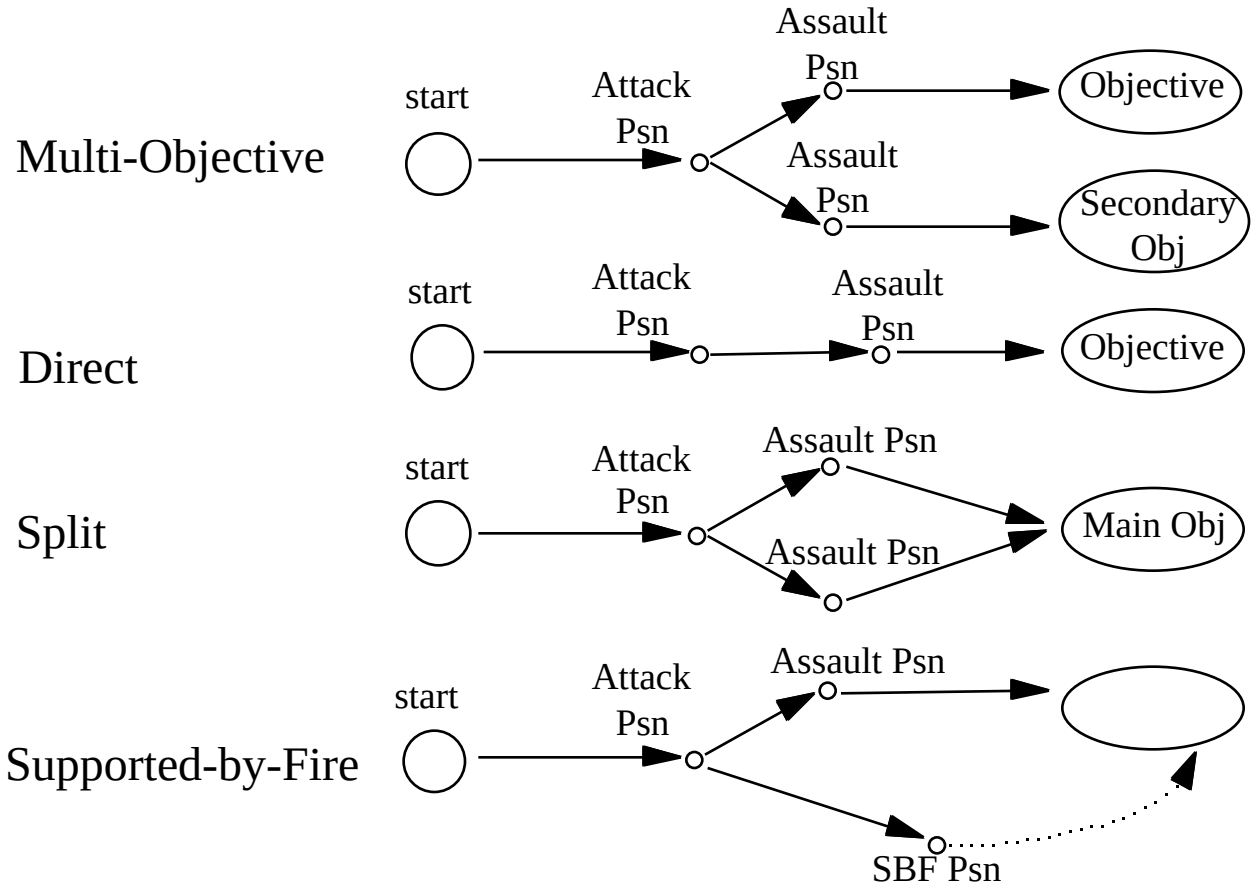
- Combinatorial Constraint Satisfaction (CCS) procedure acts as “interpreter” for high-level behaviors expressed as Constraint Sets (CS)
- CS specify how to make a coherent set of decisions.
  - finite state machines specify how to perform a temporal sequence of behaviors.
  - Decisions can be sequential or parallel, in any order.
  - CCS can recursively invoke itself (embedding CS’s)
  - CS’s can be linked at run-time (dynamic construction)
- Ability to imbed and link CS’s avoids combinatorial explosion of pre-defined CS’s

Constraint Sets

- For a given type of operation, CS specifies relevant decisions to be made and generates options for each
  - CCS procedure handles interactions between choices by searching the implicit space of possible choices
- Variables (decisions) are assigned candidate values (options) consistent with previous choices.
  - Generators suggest only values consistent with previous choices and with battle state; should suggest best-fire or least-constraining order.
  - Failure to produce options causes reconsideration of prior choices
  - Values can be specific routes, task organizations, attack options, etc.

Example Schemes

- Maneuver for Attack



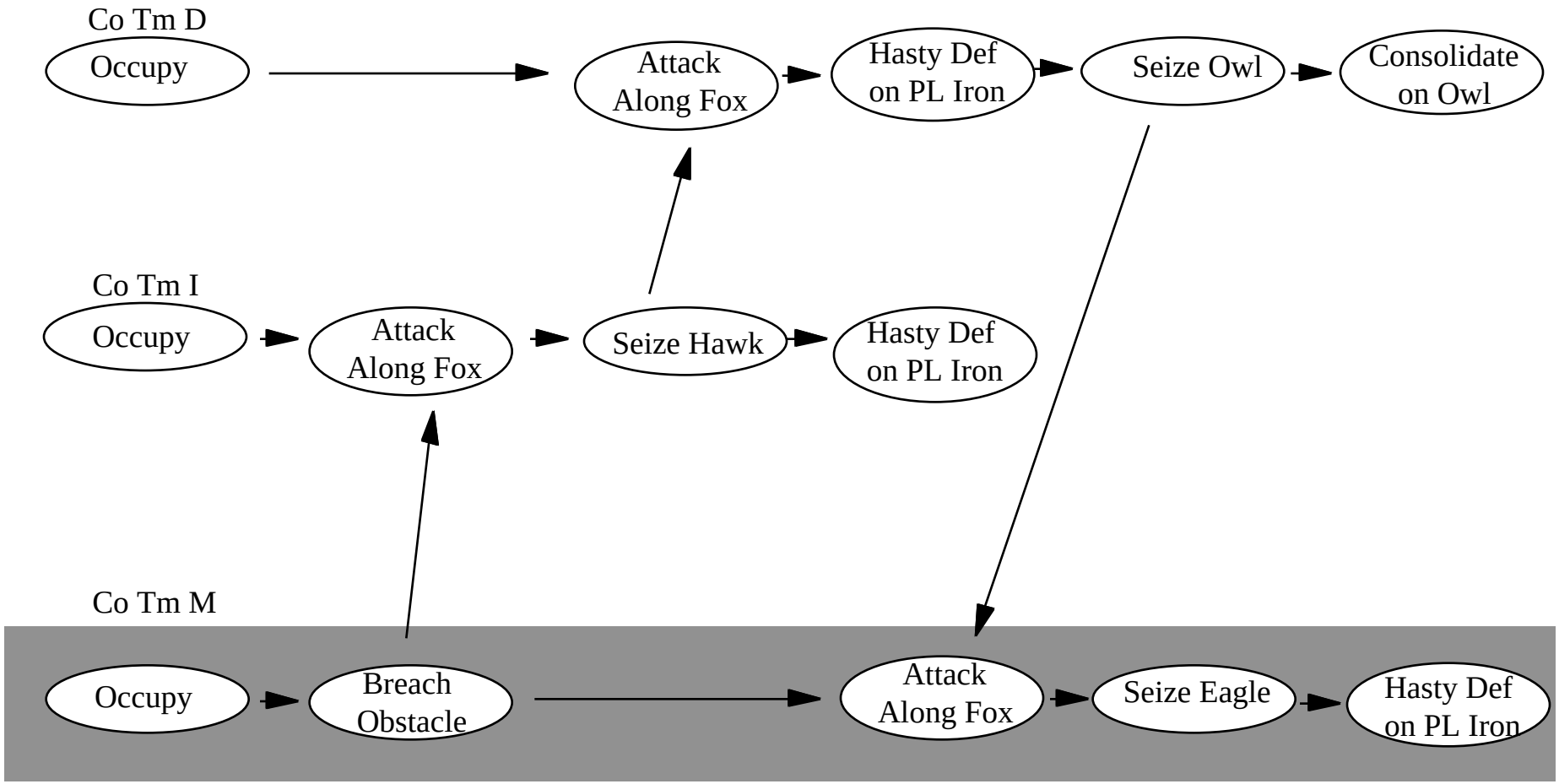
Scheme Evaluation

- Choices of Assault Types depends on:
  - Enemy Troops
    - Type, numbers
  - Terrain Features
  - Own Troops
    - type, numbers
- Choice of Attack, Assault Positions depends on:
  - Line of departure
  - Terrain features available
  - Time available

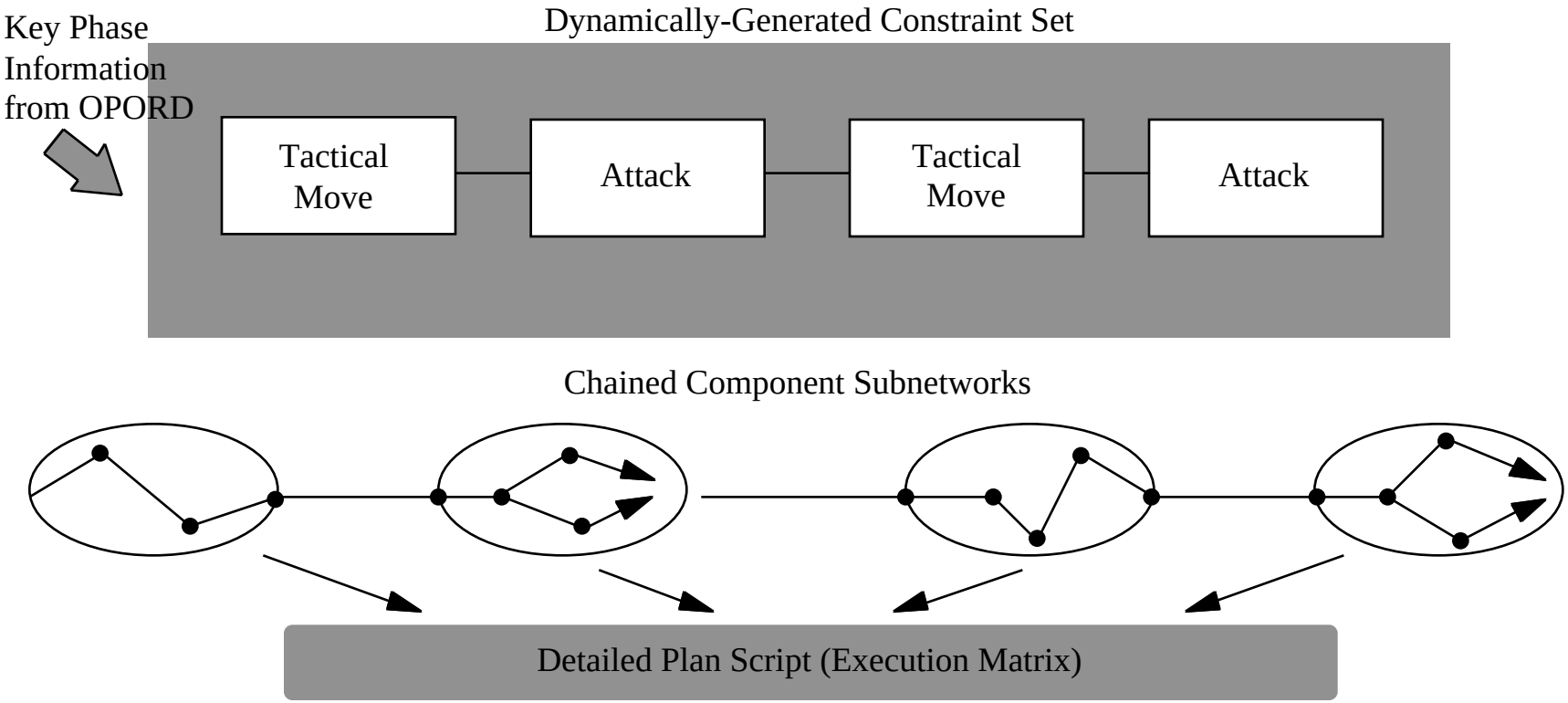
Representation of Battle State

- Interactions with Plan Generation
  - Terrain analysis and situation awareness services are invoked by the generators of the constraint sets to support relevant decisions
- Terrain Analysis
  - Planner currently uses assault positions, avenues of approach, overwatch positions, route generation, forests, defensive battle positions, and geometric utilities
- Situation Awareness
  - Planner uses location and type of known enemy troops, time remaining, strength and type of own troops, Bn control measures.

Dynamic Construction of Constraint Sets



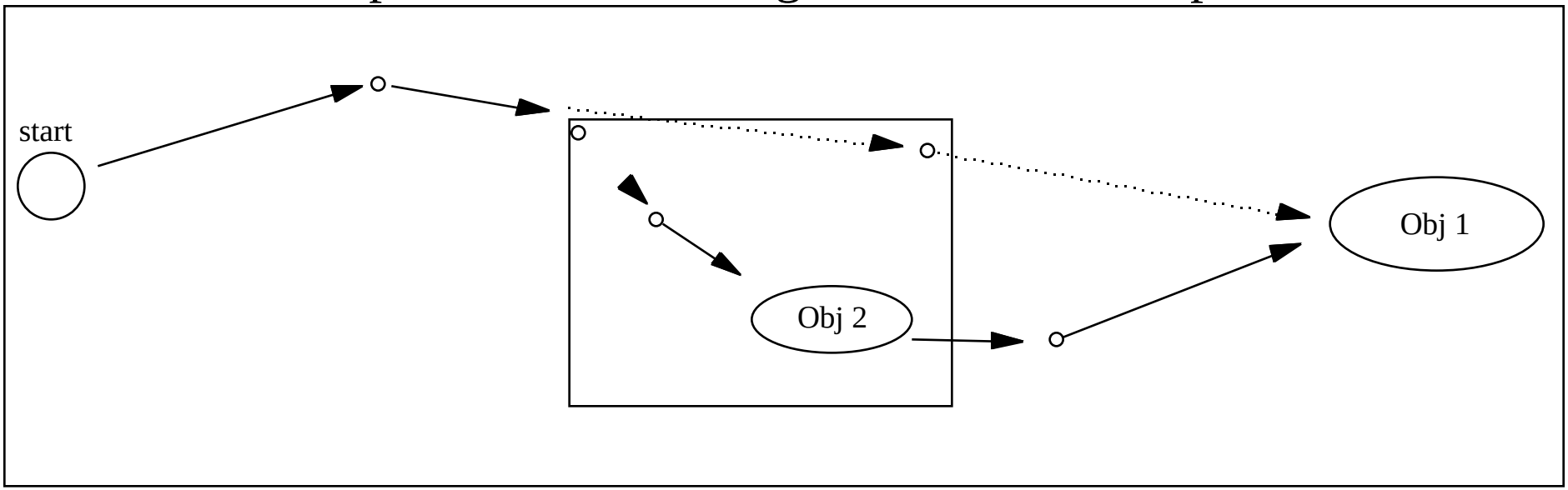
Plan Script Development Process



- Required local constraint sets (tasks) extracted from Bn OPORD
- Dynamic CS satisfies each component CS, tracks resources (forces, time), links start/end points of component CS's

Execution and Monitoring

- ACL+ segments routs according to expected characteristics (obstacles, contact, clear)
  - manages CE's reactions at Co level
- CCS is recursively invoked to plan reactions, then to replan remainder of mission
  - CS is pruned to remaining tasks and current parameters



Future Issues

- Vertical expansion to more battlefield functions.
- Vertical expansion to higher echelons and their new decision criteria
  - Implementation CS's applicable at multiple
- Improvements to basic CS/CCS mechanism
  - Implementation of loose constraints
  - More ways of dynamically linking CS's
    - linear linkages, DAG linkages
  - Dependency directed backtracking